◆ YOLO BASIN ECOLOGICAL MANAGEMENT ZONE

Photo © California Department of Water Resources

INTRODUCTION

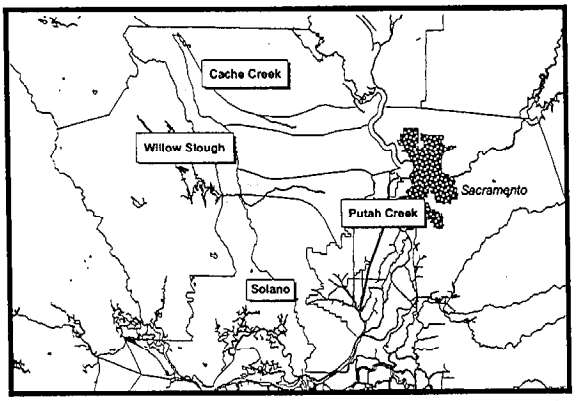
The health of the Sacramento-San Joaquin Delta depends on the health of its distinct watersheds. As with watersheds throughout California, ecological processes within the Yolo Basin Ecological Management Zone have been disrupted during the past century. Due to tenuous hydrological connections, this zone has historically made only marginal contributions to anadromous fish populations. As a result, the major focus in this zone is to increase the health of its important ecological processes, habitats, and fish, wildlife, and plant populations and make substantial contributions to the health of the Delta.

The Yolo Basin Ecological Management Zone provides diverse habitats for a wide variety of fish, wildlife, and plant communities, primarily native resident (nonmigratory) fishes, riparian communities, seasonally and permanently flooded wetlands, wildlife, waterfowl, and occasionally fall-run chinook salmon and possibly steelhead trout. The portion of the Yolo Bypass north of the Interstate 80 causeway is included in this zone and is an important migratory route during wet years for downstream migrant chinook salmon, steelhead, and other native and anadromous originating from up stream areas. When flooded, the Yolo Bypass provides valuable spawning habitat for native resident fish, including splittail.

DESCRIPTION OF THE MANAGEMENT ZONE

The Yolo Basin Ecological Management Zone encompasses the southwest portion of the Sacramento Valley adjacent to the Delta. It includes the following Ecological Management Units:

- Cache Creek
- Putah Creek
- Solano
- Willow Slough



Location Map of the Yolo Basin Ecological Management Zone and Units.

Portions of the Yolo Basin Ecological Management Zone are extensively developed for urban and agricultural land uses. The basin includes the cities of Vacaville, West Sacramento, Woodland, Winters, and Davis. It also includes the northern end of the Yolo Bypass at the mouth of Cache Creek, between the Fremont weir and Interstate 80, and the Sacramento Bypass between the Sacramento River and the Yolo Bypass.

The Cache Creek Ecological Management Unit, at the northern end of the Yolo Basin Ecological Management Zone, encompasses the lower valley watershed of Cache Creek (downstream of Capay Dam near Esparto) and the northern end of the Yolo Bypass. The Putah Creek Ecological Management Unit is in the central portion of the zone, encompassing the Putah Creek watershed downstream of Monticello Dam (near Winters). The

Solano Ecological Management Unit includes the nontidal watershed of the Cache-Lindsey Slough complex of the North Delta Ecological Management Unit and the Montezuma Hills.

Important ecological processes within the Yolo Basin Ecological Management Zone include streamflow, stream erosion, and natural sediment supply. The most valuable habitats are riparian and riverine aquatic. Although restoration efforts within the Ecological Management Units have improved portions of the riparian corridors, many specific improvements are needed to more fully restore ecological health throughout the entire Ecological Management Zone. The greatest needs are to maintain processes more closely linked to the natural streamflow regime and to restore connectivity to the Yolo Basin and Delta. Developing additional sources of water to improve low flow conditions and restoring riparian and stream channel corridors will improve the ecological health of the lower basin watersheds. Restoring upper watersheds by reducing forest fuels, improving oak woodland, forest, and rangeland management, and reducing sources of bioavailable mercury will help ensure that a clean water supply is available in the basin.

Historically, fall-run chinook salmon, steelhead trout, many native resident fish species, waterfowl, shorebirds and wading birds, and riparian wildlife were abundant in areas within the basin. Agricultural and urban development, recreation, infrastructure, mining, and flood control projects have eliminated much of the fish and wildlife habitat. Salmon and steelhead migrations within the creeks are now limited to high flow events, when there is connectivity to the Delta. Opportunities to restore these anadromous fish populations should not be overlooked.

Important habitats within the Yolo Basin Ecological Management Zone include stream and slough channels for fish migration and holding, spawning, and nursery habitats. Seasonally flooded wetlands are prevalent throughout the lower basin, and these are important habitat areas for waterfowl, shorebird, and wading bird guilds. Riparian corridors along basin creeks and sloughs are important habitat areas and migration corridors for wildlife and waterfowl.

Notable stressors to ecological functions, processes, habitats, and species in this Ecological Management Zone are:

- water diversions and past gravel mining in the streams,
- insufficient available flow to maintain a continuous riparian corridor,
- mercury contamination from natural and previously mined sources that is taken up through the aquatic food chain, and
- poor quality agricultural tailwater entering the Yolo Bypass canals and sloughs.

The prevalence of non-native plant species (e.g., tamarisk, giant reed, eucalyptus, and water hyacinth) is a major factor limiting the quality and extent of riparian and riverine aquatic habitats, especially in areas adversely affected by past gravel mining, flood scour, and low streamflow.

LIST OF SPECIES TO BENEFIT FROM RESTORATION ACTIONS IN THE YOLO BASIN ECOLOGICAL MANAGEMENT ZONE

- chinook salmon
- steelhead
- native resident fishes
- plants and plant communities.

DESCRIPTIONS OF ECOLOGICAL MANAGEMENT UNITS

CACHE CREEK ECOLOGICAL MANAGEMENT UNIT

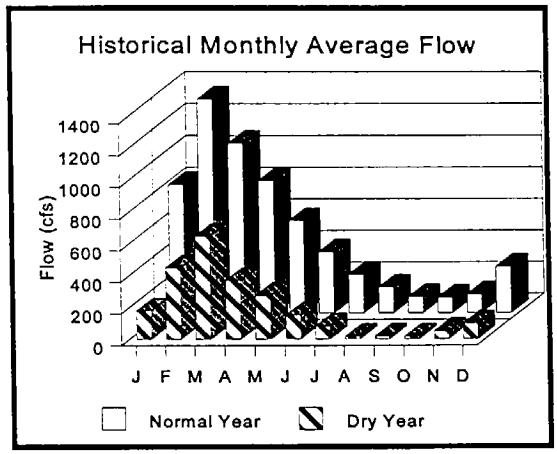
Cache Creek has a watershed of about 1,300 square miles and flows out of the coastal mountains to enter the Sacramento Valley floor near Esparto. Cache Creek enters the Yolo Bypass at Cache Creek settling basin (a reclaimed tule marsh-seasonal lake area) and then flows south into the Delta through the Conway Canal, Tule Canal, lower Cache Creek and other small sloughs in the bypass. Most of the flow is diverted in the spring and summer for irrigation. High winter and early spring flows move south through the flooded Yolo Bypass or connecting sloughs to enter the Delta through Cache Slough

which then flows to the Sacramento River north of Rio Vista.

Cache Creek drains the Clear Lake, North Fork, and Bear Creek basins on the east side of the Coast Ranges. The water levels at Clear Lake and Indian Valley Reservoir are regulated for downstream irrigation diversions with a dam and gates constructed in 1915 and 1978, respectively. A powerhouse was added in 1985. The watershed upstream of Clear Lake is about 530 square miles, and the usable storage is about 300,000 acre-feet. Downstream of Clear Lake Dam is the 30-mile Cache Creek Canyon. The North Fork Cache Creek meets Cache Creek 8 miles downstream of Clear Lake Dam and is regulated by Indian Valley Dam, located 8 miles upstream of Cache Creek, with a watershed of 120 square miles and a capacity of 300,000 acre-feet. Cache Creek enters the valley floodplain at Capay Dam near Esparto, 18 miles upstream of the mouth.

No minimum flow requirements have been set for Cache Creek below Capay Dam. In some places between Capay Dam and the Yolo Bypass, the creek flows through areas where gravel mining has recently occurred, but which have not yet had time to recover naturally. In other areas, deep gravel deposits and low water tables inhibit the establishment of a sustained low-flow channel. Another major barrier to upstream fish migration is the recently enlarged outlet spillway of the Cache Creek Settling Basin. Levees confine the stream channel in the lower 8 miles of Cache Creek. These levees define a wide basin at the lower end and act as a sediment trap to preserve the flood capacity of the Yolo Bypass. The levees were raised 12 feet in 1993 to provide an additional 50 years of sediment capacity. Flows near the town of Yolo are very low during summer and fall of most years, but Cache Creek has a flashy but intermittent natural hydrograph.

Cache Creek has a natural flow pattern of high winter, moderate spring, and low summer-fall flows, typical of many western Sacramento Valley streams that originate from chaparral and oak studded foothills rather than higher snow-laden mountains. Portions of the stream are dry during summer and fall months, except for small sections upstream of Woodland receiving groundwater. Inflows to the lower basin at Rumsey in wettest years have averaged 5,000 to 10,000 cubic feet per second (cfs) in winter months and 300 to 700 cfs in summer months. There was a flood peak of 58,000 cfs in 1995. In driest years, flows may be near 0 cfs the entire year.



Cache Creek Streamflow from Upper Basin at Rumsey, 1962-1992 (Dry year is the 20th percentile year, normal year is the 50th percentile of median year.)

Low flows are further reduced by year-round diversions. The stream in the valley floor downstream of Capay Dam is often dry during summer and fall months. In dry years, average monthly winter flows peaked at 30 to 100 cfs. Unimpaired flows during March in dry years are reduced from an average of 650 to 60 cfs by diversions. Unimpaired flows during May are reduced from 260 to 0 cfs. In normal rainfall years, May flows are reduced from 590 to 10 cfs.

Because of barriers, fall-run chinook salmon and steelhead are believed to have migrated up Cache Creek and only on an infrequent basis. Anecdotal historic evidence suggests that in wet years, when flows in Yolo Bypass and Cache Creek are high, some fish may have reached the spawning gravels of lower Cache Creek from the Delta. In dry years, no passable connection exists for salmon and steelhead between the Delta and the mouth of Cache Creek. Fish passage may also impaired at the Cache Creek settling basin spillway and headworks.

Potentially, juvenile salmon and steelhead produced in wetter years may be lost during the spring when Yolo Bypass flows cease and juvenile salmon become trapped in the creek or ponds and dead-end sloughs of the Yolo Bypass and settling basin. In years when Cache Creek flows are high enough in winter or spring, some juvenile salmon and steelhead can migrate downstream to the Delta through the flooded bypass or the network of agricultural drains crossing the Yolo Bypass to Tule Canal.

Numerous studies performed by both state and federal agencies indicate that Cache Creek transports significant amounts of mercury into the Delta. The mercury is often associated with suspended sediment loads that occur during high flow events, when Cache Creek is hydrologically connected to the Yolo Bypass. A powerful neurotoxin, mercury can cause developmental damage in both wildlife and humans. More importantly, mercury bioaccumulates through the food chain, affecting not only aquatic organisms but higher order species that feed upon them.

Improving streamflows, gravel spawning, and riparian habitats and providing permanent connections between the mouth of the creek and the Delta would only marginally help to increase steelhead trout and fall-run chinook salmon populations. Although Cache Creek can make minor contributions to fall-run chinook salmon populations in some years, significant resources would be required to provide the necessary holding, spawning, rearing, and migration habitat. However, steelhead populations, unlike chinook salmon, can exist in streams that have infrequent connectivity to the ocean. The variable life-history of steelhead/rainbow trout populations allow them to persist in the mid- to high-elevation stream reaches indefinitely if there are suitable habitat conditions, despite the loss of connectivity to the ocean. Although these sub-populations may be small, they are important to the persistence of the basin-wide population as a whole and contribute to the overall population viability when access is restored in wet years (IEP Steelhead Project Work Team 1999), and should not be overlooked.

The riparian corridor must be improved significantly in several areas; some areas have been denuded and will require a more intensive revegetation effort. This has been aided by the elimination of commercial instream gravel mining in the creek bed under Yolo County's new Cache Creek Area Plan, with all new mine permits restricted to off-channel sites. In addition, several replanting projects by non-profit organizations and government agencies are currently underway. Recent proposals to create off-channel storage facilities using water conveyed from Cache Creek in winter and spring would also permit recharge of groundwater resources that may improve the survivability of vegetation during low-flow seasons.

There are several factors that combine to constrain efforts to establish salmon and steelhead habitat. The natural geomorphology of the stream is not conducive to supporting a continuous, year-round stream. The need to maintain the flood control capacity of the river floodplain and the Yolo Bypass restrict the feasibility of creating a natural riparian system in the lower creek. Most important of all, the high levels of mercury contamination measured in the creek are a direct and significant threat to the health of the species. Until such time as the source of the mercury is identified and the contamination remediated, Cache Creek should not be considered as healthy habitat for many aquatic species.

Salmon and steelhead migrations within the creeks have historically been limited to high flood events, when there was connectivity to the Delta. However, salmon and steelhead have not been documented to be present in Cache Creek for many years. Their use of Cache Creek is restricted to occasional efforts at colonization when high flows support up-and downstream migration. Opportunities to restore these anadromous fish populations continue to be limited and restoration efforts will emphasize restoration of ecological processes and the elimination or reduction of stressors such as mercury contamination and invasive plants.

Supporting the involvement of local citizens and interested parties in existing organizations such as the Cache Creek Conservancy and Cache Creek Stakeholders Group would help to restore and maintain Cache Creek. Similarly, developing and implementing a comprehensive watershed management plan as required under the Cache Creek Resource Management Plan (approved in 1996 by Yolo County as a regulatory and planning document to maintain flood control capacity, reduce bank erosion in the channel, and preserve and restore the riparian corridor) could facilitate restoring and maintaining Cache Creek. Upper watershed health can also be improved by reducing forest fuels and implementing other watershed improvement practices to protect streamflows, stream channels, and riparian habitat and minimize sediment input to the stream.

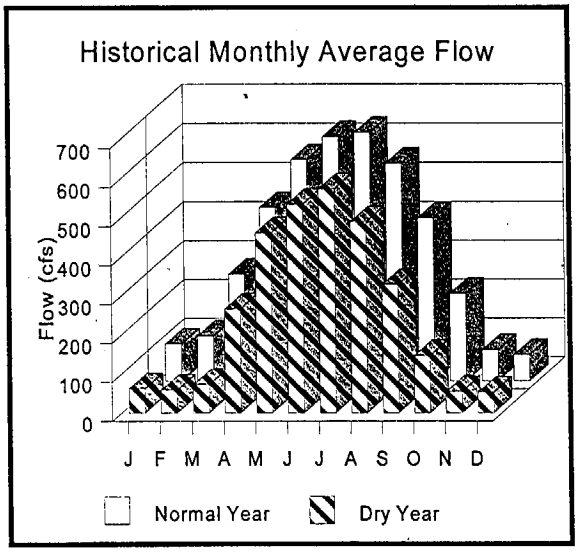
Riparian habitat can be restored by providing adequate streamflows when available, protecting the natural sediment supply, promoting the conservation and expansion of the active floodplain, and protecting

shorelines from livestock grazing upstream of Capay Dam. Planting vegetation or regrading the disturbed channel and floodplain will hasten and sustain recovery in some areas. Major efforts are required to control or eradicate tamarisk and giant reed infestations which interfere with natural vegetation succession by native tree species.

PUTAH CREEK ECOLOGICAL MANAGEMENT UNIT

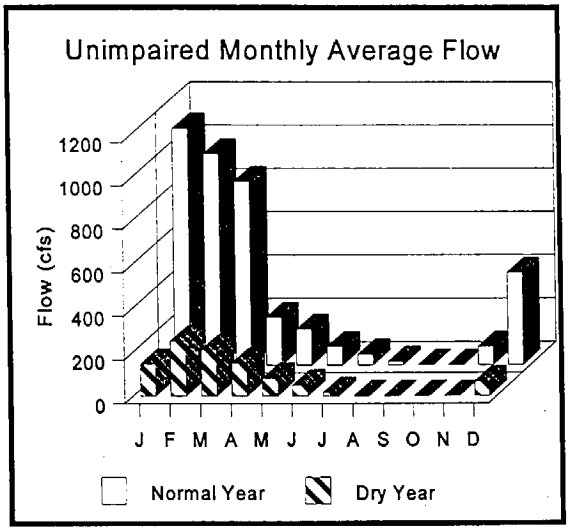
Putah Creek has a watershed of about 710 square miles and flows out of the coastal mountains to enter the Sacramento Valley floor near Winters. Putah Creek flows into the Yolo Bypass at the Putah Creek sinks (a historical tule marsh-lake area). In most wet years, the creek flows to the Yolo Bypass and then flows south through Tule Canal to the Sacramento River. Monticello Dam (constructed in 1956) forms Lake Berryessa from Putah Creek on the east side of the coastal range. Below Monticello Dam, the creek flows into Solano Lake, formed by the Solano Diversion Dam (constructed in 1959). Below Solano Diversion Dam, the creek flows east through Winters and Davis.

Most of Putah Creek's flow below Monticello Dam originates from Lake Berryessa, which has an average outflow of approximately 350 cfs. Unimpaired flows into the Lake Berryessa watershed formerly peaked in winter. In wettest years, winter flows averaged 4,000 to 9,000 cfs. Lowest flows occur in summer and fall.



Putah Creek Streamflow below Monticello Dam, 1961-1991 (Dry year is the 20th percentile year, normal years if the 50th percentile year or median year.)

In driest years, flows in winter months averaged only 20 to 70 cfs. In wetter years, summer and early fall flows averaged 20 to 100 cfs.

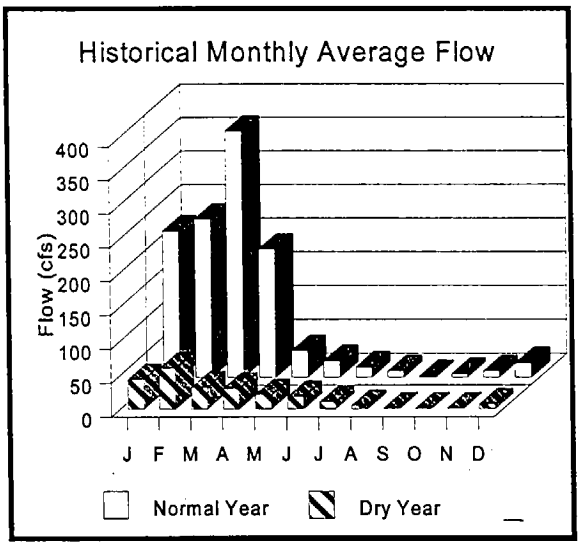


Putah Creek Unimpaired Streamflow at Lake Berryessa, 1961-1991 (Dry year is the 20th percentile year, normal year is the 50th percentile or median year.)

The natural flow pattern has been altered by water storage in Lake Berryessa and spring through fall irrigation releases. Flows from Monticello Dam are high in summer and low in winter in all but the wettest years. Wet-year spillage flows still average 4,000 to 8,000 cfs in winter; however, in normal and dry years, winter flows are generally less than 100 cfs. Even in the driest years, irrigation releases from late spring to early fall are 200 to 400 cfs above Solano Dam but near zero below the diversion dam.

The largest diversion is the Putah South Canal diversion at Solano Diversion Dam; this and other irrigation diversions reduce flows to very low levels in all but wet years and in all months. Flows near Davis are very low during summer and fall of most years, generally 0 to 60 cfs. Spillage flows reach 4,000 to 7,000 cfs in the winter of wet years, but only 4 to 20 cfs in driest years.

Historically, chinook salmon migrated at least as far as the town of Monticello (now under Lake Berryessa) (Yoshiyama et al. 1996). Solano Diversion Dam is now the upstream terminus of salmon and steelhead migration. Some fall-run chinook salmon and steelhead still migrate up Putah Creek in wet years (fall-run chinook adults were observed in 1997 and 1998). In dry years, no viable connection exists between the Delta and Putah Creek for salmon and



Putah Creek Streamflow near Davis, 1961-1971, 1973-1975, and 1978-1984 (Dry year is the 20th percentile year, normal year is the 50th percentile or median year.)

steelhead. In wet years, when Yolo Bypass and Putah Creek flows are high, fish can reach spawning gravels in lower Putah Creek from the Delta. Significant losses of juveniles can occur in spring if low flows or barriers limit connections in the Yolo Bypass, or in wet years when Yolo Bypass floodflows recede and juvenile salmon become trapped in seasonal ponds, disconnected canals, and sloughs in the bypass. If Putah Creek flows are high enough in winter or spring, some juvenile salmon and steelhead can migrate downstream through the Delta through canals along the east side of the Yolo Bypass.

Native fish species, such as hitch, squawfish, and suckers, are an important component of the Putah Creek watershed and are a primary focus for management and restoration efforts. Native fish populations are very low in lower Putah Creek except for the two-mile reach immediately below Solano Diversion Dam. The length of this reach is insufficient to insure the long-term viability of the native fish assemblage and a goal is to restore these native fishes to a stat of "good condition." Good conditions mean that fish of all ages are present in sufficient numbers over a large enough habitat area to afford the population the ability to recover form mortalities caused by unexpected disasters (i.e., pesticide spills; large, rapid sediment releases from Lake Solano, etc.); environmental factors; angling; and predation. Habitat conditions that promote successful reproduction, growth and survival of young fish, and the growth and survival of adult fish are essential (Trihey & Associates 1996).

Improving streamflow, spawning gravel, and riparian habitats and providing permanent connections between the mouth of the creek and the Delta will increase opportunities for steelhead trout and fall-run chinook salmon to use Putah Creek. Putah Creek can make minor contributions to fall-run chinook salmon and steelhead populations if adequate holding, spawning, rearing, and migration habitat are provided. Adequate streamflows are important to maintain and restore the connections between upstream spawning and nursery areas with the Delta.

Actions to restore and improve conditions for chinook salmon and steelhead are more likely to succeed during years of normal to above-normal rainfall. Supplementing flows from Monticello Dam (Lake Berryessa) through the Solano Diversion Dam during critical migration periods would help maintain and improve flows. Providing supplementary flows into and through the Yolo Bypass sloughs, either from the Colusa basin drain through the Knights Landing Ridge Cut Canal or the Sacramento River through the Fremont weir near Verona, would provide the necessary flows in drier years to let fish pass from the creek mouth to the Delta. The goal is to provide adequate flows for adult salmon migration in fall, fry rearing in winter, and spring juvenile outmigration in all but the driest years. Minimum flows in upstream summer rearing areas below Solano Diversion Dam would be required to sustain the steelhead population.

Inadequate spawning gravel may be a significant factor limiting salmon and steelhead production, especially in the upper reach below Solano Diversion Dam. Existing gravel sources should be protected, and the natural supply should be added to the creek where and when necessary. Past gravel mining operations along the stream channel, floodway clearing, and grading and bank protection in the floodplain and along Dry Creek (a major source of gravel to Putah Creek downstream of Solano Diversion Dam) may also inhibit gravel recruitment downstream. This reach offers excellent habitat for oversummer rearing of juvenile steelhead when flows and water temperatures are adequate.

The riparian corridor condition must be improved significantly in several areas. Some areas have been

denuded and will require a more intensive revegetation effort. Gravel mining operations in the creek bed were discontinued in the 1960s, but the major gravel and sediment source for the lower creek was eliminated by the construction of Solano and Monticello Dams.

Developing and implementing a comprehensive watershed management plan for both the upper and lower watersheds, and implementing the lower Putah Creek management recommendations prepared in 1994 by the U.S. Fish and Wildlife Service (USFWS) and the Lower Putah Creek Coordinating Committee, would facilitate restoration and maintenance of Putah Creek. Above Lake Berryessa, upper watershed health should be improved by reducing forest fuels and the opportunity for catastrophic wildfire and implementing other watershed improvement practices to protect streamflows, stream channels, and riparian habitat and minimize sediment input to the stream. Below the lake, efforts should focus on protecting riparian habitat, providing adequate gravel spawning areas for salmon and steelhead, and improving stream channel conditions.

Riparian habitat can be restored or enhanced by providing adequate floodplains along the channel and protecting shorelines from grading, bank filling, and native vegetation removal to expand orchards or urban and industrial facilities. Planting vegetation or regrading the disturbed channel and floodplain will hasten and sustain recovery in certain areas. Major efforts are required to control or eradicate eucalyptus tamarisk and giant reed infestations, which interfere with natural vegetation succession by native tree species. These efforts will involve coordination with the local jurisdictions (Yolo County and the cities of Winters and Davis), University of California (UC) Davis, the U.S. Bureau of Reclamation (Reclamation), Solano County Water Agency, Putah Creek Landowners Association, and the Putah Creek Council.

Adequate screening systems are needed on the Putah South Canal diversion if fish passage is to be provided along Solano Diversion Dam. Small, unscreened diversions in Putah Creek need to be screened to protect juvenile fish.

Providing fish passage at Solano Diversion Dam would allow salmon and steelhead passage into the cold tailwaters of Monticello Dam. The interdam reach—several miles of high-quality riparian and shaded riverine aquatic (SRA) habitat—currently supports a native and stocked trout fishery. With appropriate spawning gravels, the 12-mile reach between Solano Diversion Dam and Monticello Dam could provide good spawning and rearing habitat for salmon and steelhead. This reach offers excellent habitat for oversummer rearing of juvenile steelhead.

Solano Ecological Management Unit

The southern portion of the Yolo Basin Ecological Management Zone is the Solano Ecological Management Unit. This unit encompasses small watersheds above the tidal Delta, south of Putah Creek and east to the Delta. Most of this area is within the Cache Slough and Lindsey Slough watersheds. The unit also includes the Montezuma Hills, which are not part of the Delta as it is legally defined.

Although salmon and steelhead are rarely found in this unit, native resident fish do occupy creeks and sloughs. Riparian corridors of these creeks and sloughs support vegetation, waterfowl, and wildlife. Upland habitats include vernal pools, valley oak woodlands, and grasslands. Scattered areas of seasonal and perennial wetlands and aquatic habitats exist throughout the unit.

Many of the vernal pools within this Ecological Management Unit are in a degraded condition due to land use practices (e.g., discing and cultivation) and could be improved. The potential for restoring native perennial bunch grass is high, as well as is restoring some of the rare vernal pool plant species.

Willow Slough Ecological Management Unit

Willow Slough Ecological Management Unit is comprised of approximately 131,000 acres of productive farmland. The watershed is bounded and intersected by half a dozen natural riparian waterways, supporting an extensive irrigation and drainage system. Winter runoff from the Vaca foothills to the west enters this series of tributaries to terminate in the Yolo Bypass. Even during years of normal rainfall some downstream areas flood and larger events have involved parts of the cities of Davis and Winters. Very little winter water is held back or

captured in the natural systems. Summer use links the natural system with Cache Creek diversions and the Yolo County Flood Control and Water Conservation Districts (FCD) canal system to deliver irrigation water and remove related drainage flows.

No major surface water impoundments exist within the watershed. The creeks have historically been managed by farmers and the FCD to remove water as quickly as possible. As a result, there is frequent downstream flooding, enormous movement of sediment, and lost riparian habitat, wildlife populations, and biodiversity. A consequence of traditional farming practices has been the elimination of functioning seasonal wetlands and loss or degradation of riparian systems. These systems historically transported anadromous species such as chinook salmon and steelhead in years when there was adequate streamflow. As recently as 1986, an adult steelhead was found in Willow Slough. Once health natural streamways are now barren or invaded by exotic plant species that contaminate fields and roadsides requiring high maintenance and chemical use with little ultimate control.

Agriculture is the primary economic enterprise throughout the watershed. Crops include lowland acres of alfalfa, irrigated row crops, and orchards. Dryland grains and rangeland grazing characterize the upland hills. The lower irrigated croplands are made up of highly productive deep alluvial soil as well as heavier clay and alkali soils. The latter are generally used for rice production. Intensive "clean" agricultural practices in the watershed have had significant negative impacts on riparian system, wetlands, upland wildlife habitat, water quality, and flooding. A change in land stewardship practices can correct the negative impacts while maintaining, and in some cases, improving the agricultural's economic base.

The highest elevations of the watershed consist of chaparral and blue oak woodlands. Most of the habitats are in relatively good condition, although heavy grazing pressure impacts the grasslands and riparian areas, especially in the lower reaches. The lower foothills are mixed blue oak woodlands and grassland or dryland grain areas. Much of this acreage is enrolled in the federal Conservation Reserve Program (CRP) and consists of non-native annual grasses and forbs.

Historically, the waterways across the county were rich and biologically diverse because of their system of interconnected streams, wetlands, and dry uplands. Some narrow remnants of these systems can still be found but most have been removed as part of agricultural practices. Much of what remains is of a weedy nature, and is not compatible with adjacent agriculture, and requires continuous maintenance.

Where areas of natural sloughs remain, seasonal flows support riparian vegetation consisting of valley oak, foothill pine, some willows, toyon, buckeye, wild rose, elderberry, and other associated species. Many wildlife species use these corridors including deer, quail, raptors, gray fox, and tree squirrels. The large trees provide important nesting sites for the endangered Swainson's hawk and other species. Thickets of elderberry, rose, button willow, mulefat, sedges, rushes, and grasses provide important food, cover, and migration corridors of many species. Intact riparian systems also provide important bio-filtering of runoff waters. By trapping sediments and chemicals, water quality improves in downstream aquatic systems of the Yolo Bypass and Sacramento River.

VISION FOR THE ECOLOGICAL MANAGEMENT ZONE

The vision for the Yolo Basin Ecological Management Zone is to protect natural ecological processes and habitats to a sufficiently healthy condition to support native resident fish populations in basin watersheds. The overall vision also includes visions for ecological processes, habitats, species, stressors, and the Ecological Management Units.

VISIONS FOR ECOLOGICAL MANAGEMENT UNITS

CACHE CREEK ECOLOGICAL MANAGEMENT UNIT

The vision for the Cache Creek Ecological Management Unit is that native resident fish will be sustained by improving streamflows, fish passage, riparian habitat, and spawning gravel recruitment and by screening unscreened diversions.

Putah Creek Ecological Management Unit

The vision for the Putah Creek Ecological Management Unit is that native resident fish will be protected and enhanced by improving stream channel characteristics, instream habitat, streamflows, fish passage, riparian habitat, and spawning gravel recruitment and by screening unscreened diversions. Opportunities to promote use by chinook salmon and steelhead trout will be further evaluated.

Solano Ecological Management Unit

The vision for the Solano Ecological Management Unit is that creeks and sloughs and the associated riparian, wetland, and upland habitats in the unit will provide connections to the North Delta. Populations of native resident fish, including Sacramento splittail and delta smelt, may be enhanced by improving conditions in these habitats.

Willow Slough Ecological Management Unit

The vision for the Willow Slough Ecological Management Unit is to integrate agriculture, natural habitats, and urban development in a manner to support ecological health.

Visions for Ecological Processes

Central Valley Streamflow: Streamflows shape channels, support riparian vegetation, and provide habitat for fish and other aquatic species. Streamflows also transport sediments, nutrients, and juvenile fish. The vision is that streamflows in Cache and Putah Creeks will support stream channel maintenance processes, such as sediment transport and meander (consistent with flood protection and adjoining land uses), a healthy riparian zone, and sustainable native resident fish populations.

Coarse Sediment Supply: The availability and quality of sediments within the active stream channel are important for supporting natural stream channel dynamics, channel maintenance, soil medium for vegetation, and stream substrate. Sediments also include gravel, which provides for fish spawning and invertebrate production. The vision for coarse sediment supply is that a sediment equilibrium will be achieved that balances sediment transport with sediment input to make suitably sized gravels available for fish spawning and enhances riparian plant life.

Natural Floodplain and Flood Processes: Stream-floodplain interactions are an important ecological process. Streams need the opportunity to inundate their floodplains on a regular cycle to support riparian regeneration, nutrient input to the system, and to erode and deposit sediments. The vision for floodplains in the Yolo Basin Ecological Management Zone is that Cache and Putah Creek will seasonally flood their active floodplains. The vision also anticipates that the flood capacity and biological productivity of the flood bypass system will be increased by improving conditions that support habitat and juvenile and adult fish survival.

Vision for Habitats

Riparian and Riverine Aquatic Habitats: A healthy riparian corridor provides a migratory pathway linking lower and higher elevation habitats for terrestrial species, such as mammals and birds. Health riparian systems also produce and contribute to shaded riverine aquatic (SRA) habitat, which can provide cover in the form of shade or woody debris. The vision for riparian and SRA habitats is that they will provide a migration corridor between the Delta and upstream habitats that support terrestrial and aquatic species.

Seasonal Wetland Habitat: The vision is that increased seasonal flooding of leveed lands, use of the Yolo Basin's natural flood detention capacity, protection and enhancement of existing wetlands, and development of cooperative programs with local landowners will contribute to increased habitats for waterfowl and other wetland dependent fish and wildlife resources.

Freshwater Fish Habitat: Freshwater fish habitat is an important component needed to ensure the sustainability of resident native and anadromous fish species. The streams in the Yolo Basin Ecological Management Zone are a combination of fall-run chinook salmon spawning streams in some years of early rainfall but more typically hitch streams during most years (Moyle and Ellison 1991). The quality of

freshwater fish habitat in Cache Creek, Putah Creek, and Willow Slough will be maintained through actions directed at streamflows, coarse sediment supply, stream meander, natural floodplain and flood processes, and maintaining and restoring riparian and riverine aquatic habitats.

ESSENTIAL FISH HABITAT: Both Cache Creek and Putah Creek are identified as Essential Fish Habitat (EFH) based on the definition of waters currently or historically accessible to salmon (National Marine Fisheries Service 1998). Key features of EFH to maintain or restore in these creek include substrate composition; water quality; water quantity, depth and velocity; channel gradient and stability; food; cover and habitat complexity; space; access and passage; and flood plain and habitat connectivity.

VISIONS FOR REDUCING OR ELIMINATING STRESSORS

WATER DIVERSIONS: Diversion can dewater stream reaches and cause direct mortality to juvenile fish by entrainment. The vision is that additional water supplies will be developed to ensure that diversions will not impair efforts to establish sustainable populations of native resident fish species.

GRAVEL MINING: Gravel mining can remove significant quantities of sediments from the active stream channel. This loss of sediments, often in the form of gravel and sand, can have significant adverse affects on stream channel dynamics and riparian succession. The vision is that intensive gravel mining activities will be relocated to sites outside the active stream channels while allowing for continued stream restoration, flood maintenance, and erosion control.

INVASIVE RIPARIAN AND MARSH PLANTS: Invasive plant species can outcompete and displace valuable native species. Invasive plants often have little or no value to native wildlife and are de-stabilizing natural ecosystem functions and processes. The vision is that invasive plants will be controlled to allow native riparian plant species to propagate naturally.

PREDATION AND COMPETITION: The presence of non-native fish populations in the streams of the Yolo Basin Ecological Management Zone has adversely affected native fish assemblages. This is largely a result of competition for food and space, though some of the non-native fish prey on native species. Improving habitat for native species will contribute to reducing, but not eliminating, predation and competition.

CONTAMINANTS: Reducing toxin inputs in discharges and from contaminated sediments is essential to maintain water quality. Reduced concentrations in waters entering the Delta should lead to lower concentrations in Delta water and in fish and invertebrate tissues. Fewer health warnings for human consumption of Delta fish and improved foodweb productivity would also be expected.

VISIONS FOR SPECIES

CHINOOK SALMON AND STEELHEAD: The vision is that the Yolo Ecological Management Zone will contribute to the recovery of fall-run chinook salmon and steelhead populations.

NATIVE RESIDENT FISH SPECIES: Many native fish species will benefit from improved aquatic habitats and stream channel/floodplain processes. Population abundance indices should remain stable or increase and population sizes should be large enough to recover from natural and human-induced disasters fully. The distribution of native resident fishes should increase with widespread habitat restoration.

PLANT SPECIES AND COMMUNITIES: The vision for plan species and communities is to protect and restore these resources in conjunction with efforts to protect and restore wetland and riparian and riverine aquatic habitats.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

All efforts proposed in the Ecosystem Restoration Program Plan (ERPP) to improve habitat and reduce stressors will be coordinated with existing State and federal programs and with local stakeholder organizations. The ERPP also supports and complements restoration efforts already underway in the Yolo Basin, including the following.

CENTRAL VALLEY PROJECT IMPROVEMENT ACT

The Central Valley Project Improvement Act (CVPIA) which calls for efforts to double the salmon